



UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/160,965 09/25/98 SHUE

S TSMC97-542/9

MM42/0124

EXAMINER

GEORGE O SAILE
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KIELIN,E

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 01/24/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/160,965

Applicant(s)
Shue et al.

Examiner
Erik Kielin

Group Art Unit
2813



☒ Responsive to communication(s) filed on Nov 19, 1998

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-12 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☒ Claim(s) ~~1-12~~ is/are allowed.

☒ Claim(s) 1-9 is/are rejected.

☒ Claim(s) 10-12 is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 1

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Drawings

1. The drawings are objected to because in specification on page 10, lines 20-22, Applicant states that the barrier layer 16 is etched away where there is no photoresist, yet the barrier layer is shown intact where there was no such photoresist. See Figures 3d and 3e, and 3g. Correction is required.

Specification

2. The disclosure is objected to because of the following informalities: (1) on page 5, line 8, insert "planarized by" after "and," and remove "the" for grammatical correctness and parallel wording of series. Appropriate correction is required.

Claim Objections

3. Claims 5, 10, and 11 are objected to because of the following informalities: (1) in line 5 of claim 5, insert "and" after "substrate" for clarity; and (2) in line 8 of claim 5, insert "said copper layer" before "filling" for clarity; and (3) on line 3 of claim 10, "trench" should be "trenches;" and (4) on line 2 of claim 11, either the word "also " should be removed, or on line 1, the claim should refer back to claim 10 rather than 5. Appropriate correction is required.

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4. Claim 3 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 1.

When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 3, 4, and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 3 recites the limitation "said barrier layer" in line 2. There is insufficient antecedent basis for this limitation in the claim. Nowhere in the "removing" step (lines 11-13) is a barrier layer mentioned.

8. Regarding claims 4 and 9, claims are indefinite because one cannot ascertain whether (1) copper is replaced after being deposited by one of the listed metals; (2) if copper is rather substituted by one of the listed metal; (3) if some combination of metals is required.

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Examiner assumes that Applicant means that the copper metal layer can substituted by a metal layer selected "from the group comprising gold, aluminum, tungsten, titanium, or silver."

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (US 4,954,459) in view of Datta et al. (US 5,567,300).

Avanzino et al. discloses the same method for making "a highly planarized integrated circuit structure" as that disclosed the instant invention. Avanzino's method employs forming a reverse tone photoresist mask which covers trenches but leaves exposed elevated regions, removing at least a portion of the elevated regions by etching, and then removing the photoresist and planarizing via CMP. (Abstract; Figs 3-9 and 10-16). Avanzino et al., however, employs the method to planarize oxides instead of metals such as copper, gold, tungsten, titanium, aluminum, and silver.

Datta et al. and references cited therein teach the benefits of reverse current electroplating for the purpose of removing unwanted metal -- particularly copper -- regions for the purpose of

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planarizing (sections entitled “Planarization is desirable for two reasons” and “There are various planarization methods ”).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the oxide used in Avanzino’s equivalent method of planarization with the material of copper or other metal and the associated electrochemical processes to yield the instant invention because highly planarized layers are desired in the art.

Examiner asserts that sealing a copper layer with a capping layer after planarization is well-known in the art.

11. Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (US 4,954,459) in view of Datta et al. (US 5,567,300).

Avanzino et al. and Datta et al. teach all of the limitations of claims 1-3 and 5-8 except for replacing the copper layer with gold, tungsten, titanium, aluminum, or silver. Applicant indicates, however, that copper can be replaced by gold, tungsten, titanium, aluminum, and silver (page 9, last line to page 10, line 2). The choice of metal is obvious because applicant indicates that the process works for each of the metals.

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Allowable Subject Matter

12. Claims 10-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. For claim 11, the objection presented in paragraph 3 of this action but also be corrected.

The prior art does not teach or suggest the selective removal of the layer to be planarized according to the dimensions of trench spacing within some critical limit.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tran (US 6,008,116) teaches the advantages of selective removal of material to improve subsequent planarization except for use with oxide layers rather than metal layers.

Ting et al. (US 5,969,422) teaches the use of barrier layers and capping layers for copper damascene.


Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980. The examiner can normally be reached by telephone on Monday to Friday 8:00 AM until 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached on (703) 308-2417. The fax phone number for the group is (703) 308-7722.

EK

January 13, 2000


Chandra Chaudhari
Primary Examiner